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Greek National Spatial Data Infrastructure: Attempts towards Design and Implementation*

Tziachris Panagiotis[1], Papadopoulou Maria[2]

[1]Rural and Surveying Engineer, MSc, Hellenic Agricultural Organization-Demeter, Greece; panostz@hotmail.com

[2]Associate Professor, Department of Cadastre, Photogrammetry and Cartography, Faculty of Engineering, Aristotle University of Thessaloniki, Greece; papmar@topo.auth.gr

Abstract

Spatial Data Infrastructure (SDI) is a long term, evolving process without a priori known results. Different countries try to develop a National SDI (NSDI) not always with a successful outcome. Although the successes are presented thoroughly (e.g. SDI best practice), it is equally important to highlight unsuccessful efforts in order to comprehensively examine different aspects of the SDI development and to acquire a more holistic approach and integrated perspective on the subject. The first Greek NSDI effort that is presented in this paper is an example of an unfruitful first attempt. Examination and assessment of this effort, lead to interesting and hopefully constructive conclusions towards a broader understanding of the SDI development. In order to assess this first effort, we define three main periods in the Greek spatial data evolution. In this paper only the first two periods are thoroughly analyzed, since the third and most recent one is still shaping. The study of the two periods showed that people, concepts and inadequacies of the first period appeared also during the second one, forming a kind of pattern. The discussion of aspects that influenced and characterized this effort reveal the multiple difficulties and problems the Greek NSDI development had to face.

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Keywords: Spatial data infrastructures, NSDI design, NSDI implementation, Greece.

1. INTRODUCTION

In Masser (2005) is stated that SDI creation is a long term, evolving process without certain and a-priori defined results. In this long "travel" of highs and lows there are major events of success and failure that significantly affect countries' SDI evolution and increase the overall knowledge and experience on the subject. Even though the successes are presented thoroughly (e.g. SDI best practice), it is equally important to highlight unsuccessful efforts in order to comprehensively examine different aspects of the SDI development and to acquire a more holistic approach and integrated perspective on the subject.

The case of the first Greek NSDI effort that is presented here is an interesting example because years of attempts and millions of Euros expended did not lead to an integrated and functional NSDI.

To better understand the subject, this paper proposes the definition of three time periods of evolution, related to Greek SDI:

1. The pre-SDI period that started in the early 90's and lasted up to 2000. This is the period during which the prominent technology for the spatial data management were the Geographical Information Systems (GIS). At that time there was a major interest in spatial data resulting in the widespread use of both data and related systems in the public organizations, the academic environment and the private sector. The foundations for the SDI developments that followed were established in this period.
2. The period of the first effort for the development of a Greek NSDI (2000-2008) which was mainly funded by the third Community Support Framework - CSF (Ministry of Economy and Finance, 2013) through the Operational Program "Information Society" - OPIS[1] (SIS, 2013).
3. The period of the second effort for a Greek NSDI that started in 2008 (along with the end of the 3d CSF) and still goes on. During this period, the Hellenic Mapping and Cadastre Organization (HEMCO) which is the National Mapping Organization (NMO) of Greece, became the head coordinating organization (Pediaditi et al, 2010) and a new NSDI proposal is soon to be presented (HEMCO, 2011) on the premise of the INSPIRE directive.

[1] OPIS is a national programme co-financed by EU.

This paper briefly refers to the pre-SDI period and mainly presents and assesses the first NSDI effort (2000-2008). Due to the ongoing nature of the second effort (third period), the corresponding time is not investigated.

Finally, it must be mentioned that the paper is based on bibliographic references as well as reports and data coming from internet sources (mainly from the period 2000-2008). The internet material was scarce and hard to find. Apart from that, during the elaboration of this paper some of it was removed from the corresponding sites. For cases like these a web archive (http://www.archive.org) was used.

2. PRE-SDI TIME PERIOD (1990-2000)

To fully understand the evolution of the Greek NSDI concept, someone should start from the 90s, when the widespread use of the GIS and Geographic Information (GI) technology started in Greece. The main characteristics of this period as described below can help us to better understand the Greek approach towards SDI.

One important characteristic of that period was the lack of linkage among the GIS users within central government organizations which sustained, managed and used spatial data (Assimakopoulos, 2000). Although most of the previous organizations kept linkages with members of other institutional groups like private sector companies or university community, they rarely worked together in solving problems concerning the combined use of their spatial data. This isolation and reluctance for cooperation became one of the major problems in the GIS period that continued throughout the following SDI period.

Another characteristic was that the predominant relevant group of the emerging Greek GIS community had mainly a surveying engineering disciplinary background. These people outnumbered and were better interconnected compared with any other disciplinary group of the Greek GIS (Assimakopoulos, 2000).

The formation of this closed group of GIS experts, shifted the emphasis of the argument in particular types of GIS applications and in specific GIS issues. This reality framed the purpose of the GIS use as well as the categories of people who were to participate in the "GIS society". Even though in the end of 90s, there was a reinforcement of the interdisciplinary contribution in the GIS community, the surveying engineers remained GIS team leaders or simple group members more than any other university graduate (Karnavou and Gritzas, 2001). Later on, these experts with their ideas and beliefs formulated also the definition, the conceptual model and the approach towards the Greek NSDI.

Thereby the imposed GIS approach was in accordance with the surveying engineering discipline that is mainly techno-centric and data-centric oriented, with focus on applications and models, and emphasis on the issues of geometry, accuracy, and digital topographic data production (Assimakopoulos, 2000). This narrow approach, which was supported by universities and their academic priorities, lacked research concerning strategies, policies, frameworks etc. that could help the progress of GI Science in Greece. Likewise the Greek public debate was limited both in quantity and in context, with conferences and seminars that emphasized GIS applications and modelling and not questions of strategy, coordination and Greek particularities (Karnavou and Gritzas, 2005).

Other problems of this period related to GIS and GI were (Karnavou and Gritzas, 2001, 2005):

- Ad hoc system introductions with no previous planning
- Stagnation of GIS groups
- Absence of periodical data updating mechanisms, data quality issues

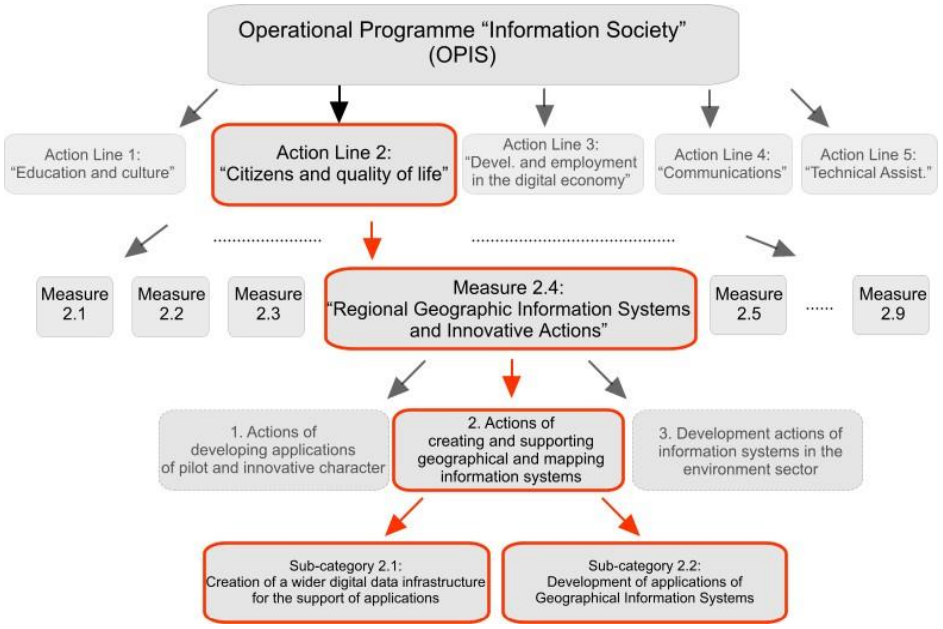
In conclusion, despite the expansion and increased use of GIS systems and spatial data at that period, the above mentioned issues formed a disadvantageous environment that affected the consequent SDI development.

3. FIRST GREEK NSDI EFFORT (2000-2008)

The first effort for the design of the Greek NSDI started in 2000 when a proposal regarding an operational plan and action plans for a Greek NSDI was formulated by HEMCO, on the occasion of the third CSF (HEMCO, 2000).

This initiative, with some changes though, was accepted and funded by the OPIS (Figure 1) and specifically in the “Actions of creating and supporting geographical and mapping information systems” that officially started in 2000 and ended in 2008.

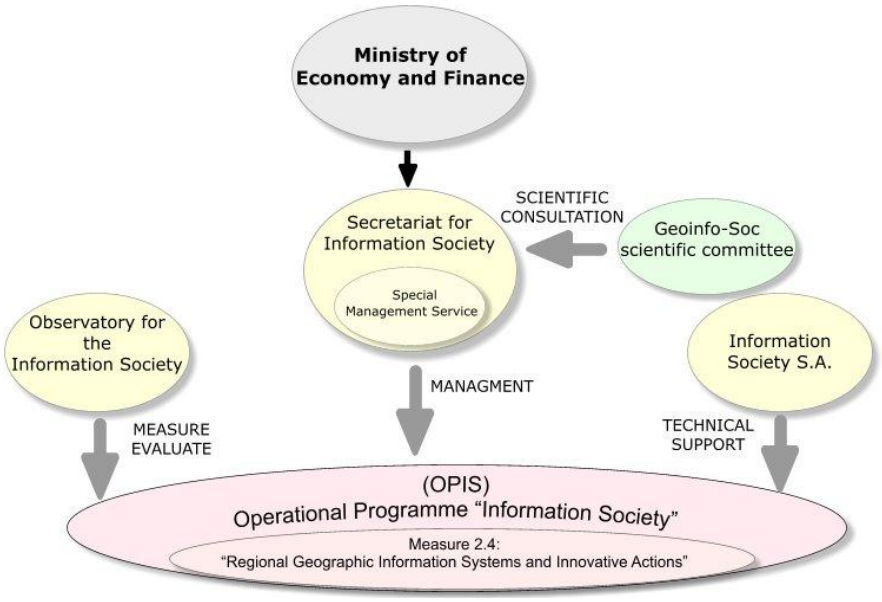
Figure 1: The Basic Structure of OPIS. The Path Concerning NSDI Is Depicted in Red Frames



These set of Actions concerned the creation of an NSDI and the development of GIS in Greece (SIS, 2005).

Three main bodies, the Secretariat for Information Society (SIS), the Information Society S.A. (IS S.A.) and the Observatory for IS S.A. were formed for the management, technical support and evaluation of the OPIS progress. The SIS was formed in December 2000 and was directly involved in the NSDI design as the responsible institutional body, while the IS S.A. provided only technical help to the final beneficiaries of "Actions 2". In figure 2 the organizational structure concerning the OPIS implementation is depicted.

Figure 2: Organizational Structure for the Support and Evaluation of the OPIS Progress



The Geoinfo Society Scientific committee (Geoinfo-Soc) (Figure 2) was founded in 2002 to support the SIS in the specialist subject of SDI and to avoid of decentralized approach that might lead to heterogeneous, non-coordinated activities (van Orshoven and Beusen, 2006). Its members were mainly prominent professors in the spatial data discipline and their tasks were to support the NSDI implementation by providing technical advisory services, to consult on the submitted proposals, to evaluate the alternative actions and to design and update a web page (http://www.nagii.gr) from which everyone interested could retrieve information about the NSDI. Their plan was also to implement the following four horizontal projects[2], for the Greek NSDI (Geoinfo-Soc, 2002):

1. Integrated National Spatial Data Infrastructure
2. Design and implementation of NSDI system and data
3. Proposal on the institutional policy framework of NSDI's spatial data
4. Responsibilities and expected deliverables from Technical Scientific Councils of the participants

The results of this first organized effort towards the creation of the NSDI for Greece were ambiguous.

[2] These four horizontal projects can also be found slightly different in the bibliography (Kavouras et al, 2003; van Orshoven and Beusen, 2006).

According to the SIS (Boviatsis, 2009), the Measure 2.4 (Figure 1) was rather successful as a great number of projects (720 for the whole 2.4 Measure[3]) were funded with budgets varying from 10.000 Euros up to 5.500.000 Euros (SIS, 2010). Through this Measure, major ministries were heftily supported (millions of Euros) in order to organize and manage their spatial data through the development and acquisition of GIS and WEB GI systems (Tsigani, 2007). Apart from the central government, regional and local governments as well as other authorities and organizations were also funded with thousands of Euros (SIS, 2010). In general, SIS seems to have fulfilled most of their objectives in a cost effective and time efficient way (SIS, 2005).

However, as for the NSDI, the results were rather disappointing. Greece is still one of the few state-members of the European Union that does not have NSDI and its various authorities have different specifications and systems regarding spatial datasets and services (Marakakis et al, 2008; Pediaditi et al, 2010).

4. ANALYSIS OF THE FIRST GREEK NSDI EFFORT

For the assessment of the first Greek NSDI effort, this paper focuses on scientifically interesting aspects that influenced and characterized this effort. These aspects are discussed in the following paragraphs.

4.1. Spatial Environment in General

Many countries claim to have developed SDIs. However these claims need to be treated with some caution. According to Masser (2005) the creation of an SDI is a long term process that may take years or even decades in some cases before it is fully operational, especially for countries without experience in SDIs or Information Infrastructures in general. It is commonly accepted that infrastructures are not developed from scratch but they are extensions of pre-existent infrastructures (Star and Ruhleder, 1996; Ciborra and Hanseth, 1998; Hanseth and Monteiro, 1998). Therefore a thorough study of the Greek NSDI development presupposes a discussion about the country's earlier spatial environment like for example the existence of the essential building blocks (Z. Nedovic-Budic and Budhathoki, 2006) or the concept of the installed base (Hanseth and Monteiro, 1998; Georgiadou et al, 2005).

As it is already mentioned, the period before the NSDI, that is throughout 90's, there was a widespread use of GI systems and technology, especially in the Greek public sector. Ideally this could form a friendly environment for the subsequent NSDI development. However this never happened due to multiple problems and major deficiencies in GIS introduction and use (see also §2).

[3] There are data only for the entire Measure 2.4 and for each funded project, but not for the three actions individually.

Therefore the existing but dysfunctional technical setup e.g. problems in spatial data and systems introduction, along with the limited organizational setup e.g. limited cooperation culture, or focusing on technical issues, played also a constraining role in the NSDI development in Greece. The GIS environment was not proper to form a stable building block for NSDI and the country was unprepared to embrace such a complex action. Moreover, the attendance of most of the Greek conferences and seminars on the subject during that time, and a detailed search in Greek proceedings and bibliography, led to the conclusion that the interest in subjects concerning SDIs in general was limited. The scene suddenly changed in 2000, when the HEMCO's proposal emerged (HEMCO, 2000), on the occasion of the third CSF. Assessing the overall situation it could be concluded that without the third CSF, there would not have been any interest in SDI development in Greece at that time.

4.2. Public Sector Approach towards NSDI

Governments play a crucial role in the SDI development and implementation as they are at the same time producers, users, policy setters, and regulators (Craglia et al, 2002) and exert a significant influence on the NSDI development (Lance et al, 2009). Furthermore de Man (2011), views the whole SDI phenomenon as emerging from the interplay between public governance and spatial information technology, influencing each other in intricate way.

Therefore the attitude and position of the public sector towards the NSDI is a significant factor of the NSDI success or failure. This attitude is affected by multiple parameters. The organizational culture of the public sector is a key factor (Dessers et al, 2010) that can become a potential barrier (Camarinha-Matos et al, 2005) that needs to be changed (Masser, 2005; Rajabifard et al, 2006; Masser et al, 2008; van Loenen and van Rij, 2008). Organizational structures and organizational practices that arise through that culture are equally important. This fact is quite interesting in relation to the disruptive nature of GIS and SDI (Ramasubramanian, 1999; Camara et al, 2006). Apart from that, organizational interoperability issues (Nedovic-Budic and Pinto, 2001) or internal problems and inadequacies like bureaucracy, internalism (van Loenen and van Rij, 2008), lack of resources and trained personnel or lack of data (Rajabifard, 2002; de Man, 2004; Georgiadou et al, 2006), affect the overall NSDI implementation.

In general, the public sector in Greece has always had difficulties in changes and administrative reforms, that even if frequently announced, are often aborted (Sotiropoulos, 2004). The introduction of new systems were often followed by delays or other problems that led to their disuse or misuse (Avgerou and McGrath, 2007; Prasopoulou, 2011). According to Ministry of Administrative Reform and E-government (2012) seven billion Euros were spent from 1996 to 2012 on Information Technology and Communication (ITC) systems that were

never used or are now obsolete, due to lack of continuity both at strategic level and in human recourses, along with a purely techno-centric approach.

Major long term problems and inadequacies that hindered the Greek public sector's modernization and, directly or indirectly, affected the SDI development were: bureaucracy and bureaucratic delays (Karnavou and Gritzas, 2005; Pediaditi et al, 2010), political interference and pressures (Karnavou and Gritzas, 2005), discrepancy between formal adaptation rules and procedures and informal practices, political favouritism and public organizations inefficiencies (Sotiropoulos, 2004), corruption (Coombes and Mentzi, 2011), a rent-seeking oriented economy (Mitsopoulos and Pelagidis, 2009) and medium e-government readiness (Sher, 2005). A credible and detailed description of the Greek central administration can be found in OECD (2011).

This deeply disturbing situation formed an unfavourable environment for the Greek NSDI. As Geoinfo-Soc stated (Kavouras et al, 2004) the Greek NSDI implementation faced: a distorted, inward looking perspective and arrogance from the public sector organizations, inability for cooperation and lack of trained personnel. Public sector organizations thought NSDI as an opportunity for unconditional funding, and the spatial data they managed as their not shareable property. Moreover they considered their role to be a significant and exceptional one, and their problems of high priority (SIS, 2003). This attitude, which was accurately characterized by Karnavou and Gritzas (2005) as "myopic", hindered the implementation of the NSDI and put forward demands for funds serving not really important issues. Consequently this false perception, which was underpinned by political pressure and influence, triggered the inattention of expert views and prevented the open and documented discussions (Karnavou and Gritzas, 2005).

Overall, the previous description highly resembles the "stand alone" stage of SDI development that van Löenen et al (2008) proposed.

4.3. NSDI Coordination Body Structure

As it is well known, SDI is fundamentally about facilitation and coordination of the exchange and sharing of spatial data between stakeholders in the spatial data community (Rajabifard and Williamson, 2000). Therefore coordination is an important issue in SDI and strong multi-agency coordinating frameworks and teams characterize the countries with the most developed national SDIs. These team's role is to mediate between inter-agency conflicts, sustain political support, raise awareness and report the results, identify gaps or inconsistencies in the legal and organizational framework and suggest remedial action to the government (Annoni et al, 2002). They must also ensure and supervise the unrestrained and sustainable development of the NSDI.

In the Greek case, the organizational structure depicted in Figure 2 had the responsibility for the NSDI design and implementation while the operational part of the NSDI was considered separate and performable by a different team[4] in a later phase. This was in accordance with the current Greek NSDI concept (see §4.4) and appeared as a more efficient and realistic solution at that time.

SIS who were the leader of the coordinating body, were an ad-hoc institutional body responsible for the timely, complete and efficient implementation of the proposed actions (mainly concerning Information Technology (IT)). SIS had neither the knowledge nor the expertise (Karnavou and Gritzas, 2005) to organize, supervise and coordinate an NSDI development and to fulfil the consequent crucial and complex role of a NSDI coordinator. The mainly IT approach and efficiency-centric management, rushed the NSDI implementation into more IT actions, and the whole assessment of the Measure into more managerial, financial and time efficiency basis. Finally, SIS's role as coordinator was short term, only in the OPIS context and ended along with the program.

For the support of SIS, the Geoinfo-Soc was addressed to special scientific issues. However they only had an advisory, supportive, non-institutional role and their proposals were, most of the times, not implemented. There were disagreements and their views were frequently bypassed (Karnavou and Gritzas, 2005). Later on their activity stopped, leaving most of their predefined tasks uncompleted. As it is presented in §4.4, only one task out of four was fully completed and a second one was partially concluded (Figure 4).

Looking back, someone could state that a different organizational structure might have a better result. A more inclusive, efficient and long term coordination team, responsible for NSDI implementation as well as operation, formed by committed representatives with interest and knowledge of the subject, would have a possibility to better address the NSDI issues. However due to problems that are described in the current and the following paragraph, this organizational structure was not something easily attained.

4.4. NSDI Design and Concepts

It is scientifically interesting to examine the first NSDI design proposal, even though it was never implemented as a functional NSDI. This design was thoroughly presented in a study (Arvanitis, 2004), which still remains the only integrated NSDI proposition for Greece up to date - 2013. In this study, a research of the international NSDIs was performed along with a presentation of the European policies regarding spatial data and specifically the new at that time, INSPIRE directive. Also a questionnaire was formulated for the assessment of the demand and use of spatial data in Greece by major organizations, public

[4] The identity of the team was not defined at that time.

authorities and universities. Finally, based on the results of the research and the questionnaire, an NSDI was proposed, in accordance with the international mainstream ideas and theories regarding SDI of that time, customized for the Greek spatial reality.

The proposed Greek NSDI was mainly focused on technology and data, with tones of overoptimistic assumptions and remarks. The main reasons for creating an NSDI (Geoinfo-Soc, 2006b) depict mainly a techno-centric position by which Greece must develop an NSDI because, among others, it is technical feasible (technology push) and because other countries do the same. For the support of the NSDI development and on the account of the "Sub-category 2.1" (Figure 1), a development model of four steps was chosen (Arvanitis, 2004). In this model, the first three steps concerned data and the fourth one referred to portals for the data disposal. Moreover the questionnaire for the assessment of the Greek spatial environment was only focused on spatial data and their use. Consequently, several presentations of the Geoinfo-Soc work, addressed mostly technical and data oriented issues like geodata availability and services, interoperability and standards (Kavouras et al, 2003, 2004).

This kind of approach was mainly imposed by the engineering background and mind-set of the members of Geoinfo-Soc and the Greek spatial data community in general, along with the lack of experience regarding SDI. It was also enforced by the need and the intention of the experts' team to solve multiple longstanding problems having to do with shortage of digital spatial data, questionable quality, lack of functional cadastre etc. along with the NSDI development.

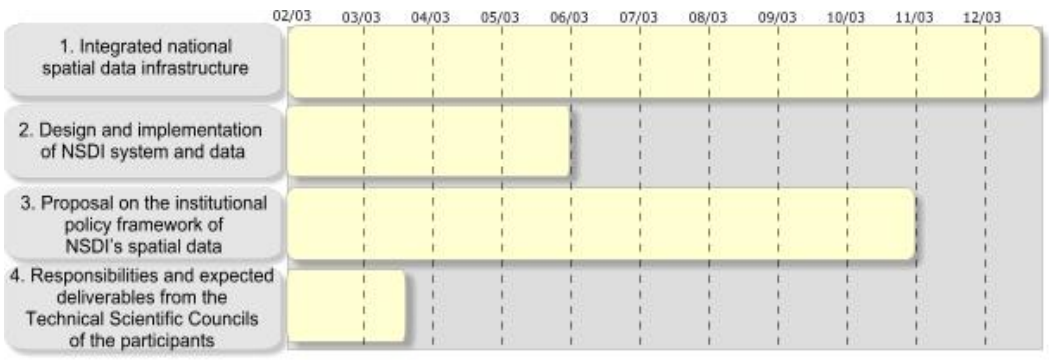
In order to promote the idea of NSDI, different and sometimes overoptimistic arguments were used saying that the NSDI could change the Greek public sector, enhance the nation's economic and social development, directly improve the public sector's efficiency and lead to the reduction of expenditures. For example Kavouras and Bantekas (1999) assert that: "...the project is innovative and of great importance for the administration improvement ..." while HEMCO (2000) states that there will be"... economic benefits from the operational improvement of the public agencies and services, and the general development..." and "...most importantly the state will come closer to the citizens and will develop better relations with them.". Finally in Arvanitis (2004) it is mentioned that some of the effects of the NSDI are the "...improvement of the efficiency of the citizens, enterprises and public sector..." and the "...reduction of taxes…".

The above-mentioned techno/data centric and rather simplistic point of view did not incorporate a more complex SDI concept and advanced SDI approaches and strategies, something understandable and rather expected as the relative theory was not fully developed and widely accepted at that time. Also social-

organizational aspects were absent and the role of the "users" was trivial that is mainly informative and educational. Therefore the NSDI design did not include proposals about apparent and well-known problems of more social-centric nature e.g. unwillingness from public authorities to cooperate or share, introversion and egocentrism etc. (Arvanitis, 2004; Kavouras et al, 2004). This depicts the dead end of a non-inclusive, non-holistic approach. Even though the team of experts realized the problems that could hinder the overall process, they did not propose a plan of addressing them since they believed that these problems were not the NSDI's responsibility, but social or political issues to be solved by the government and/or the public sector. Thus, they just brought them up only as comments, usually in cases of notifying political audiences (SIS, 2003).

It must also be pinpointed that the proposed roadmap of the Greek NSDI had inconsistencies that could raise scientific questions, as it can be seen in the project's execution timetable proposed by the Geoinfo-Soc (Figure 3).

Figure 3: The Four Projects and the Proposed Roadmap of the Greek NSDI for the Year 2003



Source: Geoinfo-Soc, 2002

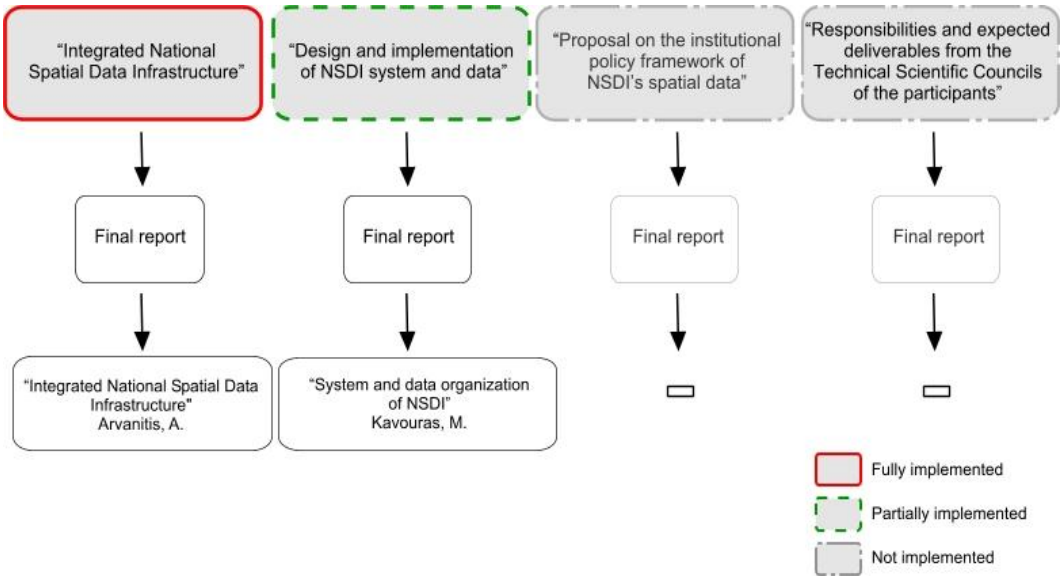
Such inconsistencies are for example the overoptimistic four month period for the overall design proposition of the Greek NSDI by the second project or its early initiation before the basic concepts of the Greek NSDI are researched and presented by the first project.

4.5. Implementation Roadmap

From the four horizontal projects that were planned from the Geoinfo-Soc, only two projects were addressed and two reports were presented (Figure 4) in 2004. The first report by Arvanitis (2004) for the first project "Integrated NSDI", concerned the overall NSDI concepts and design. The second one by Kavouras (2004) for the second project "Design and implementation of NSDI system and

data", dealt with the technical aspects of the NSDI. However the latter report was focused only on metadata and there were no references or proposals concerning spatial data. Moreover, according to bibliographic research, no other report about the different SDI technical issues was found. Therefore this second project could be regarded as partially concluded. The last two horizontal projects were never implemented (Figure 4).

Figure 4: The Status of Implementation of the Four Horizontal Projects and Reports from Geoinfo-Soc



The SIS never exploited the previous reports and as a result, it was impossible the proper interfaces and interoperable connections between the systems and the NSDI to be determined (Boviatsis, 2009).

Furthermore the initial goal of funding horizontal, effective and sustainable GI applications from a short predetermined list (Kavouras et al, 2004; Geoinfo-Soc, 2006a) was abandoned and instead a spectrum of different and incoherent applications, hard to be managed and assessed, was implemented.

From all the above it is apparent that whereas the NSDI design was partially concluded, the NSDI implementation never really started.

5. CONCLUSIONS AND DISCUSSION

This paper tries to shed light on the early Greek spatial evolution and especially on the first effort for the design and implementation of an NSDI, which was

actually never completed. Different aspects that characterized and influenced the effort are presented, like the general spatial environment in Greece, the public sector approach, the coordination team, the NSDI design concepts and the implementation roadmap.

The question that comes up through the present research is why this first NSDI effort was unfruitful. This paper argues that weaknesses and inadequacies in the abovementioned aspects, have affected the NSDI development. However it cannot be unambiguously considered that the above led to the NSDI incompletion. The observation of the NSDI progress, showed that the NSDI development was abandoned in 2004 and eventually the NSDI project was transformed into a funding action[5] without connection to the NSDI rules and obligations. It is quite possible that political events of that time, like the Greek national elections of 2004 or the change of the government in that year, could have also affected negatively the NSDI progress, leading to its abandonment.

This first unfinished NSDI effort did not give Greece the opportunity to design, implement and put into test a fully functional NSDI. Consequently, since relative experience was not gained, different false ideas and misconceptions of that period might still exist. A thorough research of the relative bibliography, revealed a “silence” on behalf of the Geoinfo-Soc and the related scientific community that enhanced the vagueness of that period. It is apparent that no one expressed any interest in examining this NSDI effort as well as in recognizing and facing the major problems that hindered the development. Under these circumstances it is possible that the same problems can also undermine the current NSDI initiative.

The overall assessment of the effort, shows a consistency in the way GIS and SDI were addressed in Greece. The scientific community who led the GIS evolution also proposed and designed the NSDI. Quite similar inadequacies of the pre-SDI period, also affected the first NSDI effort. Moreover the very concepts of the GIS and NSDI, seem to converge in the minds of the Greek spatial data community in a kind of "horseless carriage syndrome" (Harms and Yamartino, 2010). This means that they viewed the "new idea" of NSDI through the lens of the GIS paradigm that had been dominant for years. So they addressed the NSDI as a bigger, more complex GIS instead of a newly emerging and different concept that needed research and investigation, in the light of the scientific context of that period.

Furthermore it is important to state that the NSDI design and implementation were separate from the NSDI operation. According to the research this could have happened due to disputes and conflicts among the different public

[5] For public organizations (see §3), and indirectly for their suppliers from the private sector.

organizations for the leading role and the control of the Greek NSDI[6]. So to resolve this conflict, a provisional team (primarily the SIS along with GeoInfo-Soc) was accepted as responsible just to design and implement the NSDI and not to operate it. Nevertheless, this was in accordance with the prevailing Greek NSDI concept and understanding at that time, meaning, a product based, techno/data-centric approach towards a NSDI static in nature. In other words, it was regarded as an information system separable from its functional context and independent from the socio-organizational context in which the actors[7] operated. Therefore challenges like organizational differences and disparities, difficulties in coordination and cooperation, lack of consensus etc. although more or less recognized, were not encountered.

The Greek case is also an interesting example of how major funding does not ensure a successful NSDI implementation. The allocation of money alone is not an adequate and sufficient prerequisite for a sustainable NSDI development and cannot be a motive or reason for an unprepared country to get involved in such a long term and complicated process.

Another point for thinking is the inconsistency between the "State of Play" Summary reports and the SDI reality in Greece as depicted in this paper. For example the Greek NSDI for the year 2007 (Vandenbroucke, 2007) was presented as an initiative led by a National Data Producer (NDP-led), partially operational and with users involved. This contradicts the facts presented in the current paper according to which the first Greek NSDI was not NDP-led (see §3), not partially operational (see §3 and §4.5) and without users involved[8] (see §4.4).

Finally, the discussed characteristics and general environment of the Greek reality, seem to have a lot in common with inadequacies of developing countries. Lack of capacity to plan and develop SDI in an adequate and sustainable way (Rajabifard and Williamson, 2004), lack of appreciation of what SDI can and cannot do, limited resources and trained personnel, inefficient bureaucratic processes, lack of data and infrastructure (Rajabifard and Williamson, 2003), lack of capacity of public institutions (Georgiadou et al, 2005) etc., that characterize developing countries, were present in the first Greek NSDI development. Moreover, the Greek case seems to be in accordance with the "Summary of Current Conditions in Developing Countries" as it is given in the SDI Cookbook (GSDI Association, 2009). This is a worrying assumption, as major implications for the current Greek NSDI approach and design could be raised. This means

[6] In Arvanitis (2004) it is stated that the data producers were unwilling to accept other organization as responsible for the operation of the NSDI.
[7] More about the different actors and their role, see Karnavou and Gritzas (2005) or Vandenbroucke (2007).
[8] Apart from a questionnaire (Arvanitis, 2004) regarding spatial data interest and use, by Greek public sector organizations.

that besides propositions based on mainstream SDI theory itself (see for example Alexiadou and Rajabifard, 2006; Tziachris, 2010), other concepts and premises should be also taken into consideration like: information systems in transitional countries, e-governance support, enhancement of learning and transforming capabilities, administrative reforms and restructures etc. in a newly proposed NSDI approach that could address the unique Greek characteristics. And as a result a series of different actions[9] might be needed and incorporated either as part of a highly extensive customized SDI project or as a standalone separate process that should precede the SDI development.

This Greece's challenge of the concurrent confrontation of the a) various fundamental inadequacies, b) the SDI development and c) INSPIRE's compliance, actually resembles the South European countries' "simultaneous challenges" of bureaucracy, stated by Sotiropoulos (2004), that is the democratization, modernization and Europeanization at the same time. Undoubtedly, addressing this challenge is a hard task, especially in the context of the INSPIRE directive, the obligations and strict deadlines of which Greece must adhere.

REFERENCES

Alexiadou, S. and A. Rajabifard (2006). Developing national SDI platform for Greece, *Coordinates, 2*(3): 28-34.

Annoni, A., Craglia, M. and P. Smit (2002). "Comparative Analysis of NSDI", *Proceedings of the 8th EC GI-GIS, July 3-5, 2002, Dublin, Ireland.*

Arvanitis, A. (2004). *Integrated National Spatial Data Infrastructure. Research Program for the Information Society.* Thessaloniki, Greece: Aristotle University (in Greek).

Assimakopoulos, D.G. (2000). Social Network Analysis as a Tool for Understanding the Diffusion of GIS Innovations: The Greek GIS Community, *Environment and Planning B: Planning and Design, 27*(4): 627-640.

Avgerou, C. and K. McGrath (2007). Power, Rationality, and the Art of Living through Socio-Technical Change, *MIS quarterly, 31*(2): 293-315.

Boviatsis, S. (2009). "Development Projects of Integrated Geographical Information System from the "Information Society" S.A.", *Proceedings of the Interoperability in Geographic Information Day - OGC, April 3, 2009, Athens, Greece,* at http://www.infosoc.gr/NR/rdonlyres/5F3DD93C-C5BA-4022-96B3-

[9] See for example the key recommendations from OECD (2011).

687E036CFBF5/5978/InteroperabilityinGeographicInformationDaygr.pdf [accessed 20 May 2013] (in Greek).

Camara, G., Fonseca, F., Monteiro, A.M. and H. Onsrud (2006). Networks of Innovation and the Establishment of a Spatial Data Infrastructure in Brazil, *Information Technology for Development, 12*(4): 255-272.

Camarinha-Matos, L.M., Afsarmanesh, H. and M. Ollus (2005). *Virtual Organizations: Systems and Practices*, Berlin: Springer.

Ciborra, C.U. and O. Hanseth (1998). From tool to Gestell: Agendas for Managing the Information Infrastructure, *Information Technology & People, 11*(4): 305-327.

Coombes, T. and N. Mentzi (2011). Tackling Corruption in Greece, *Trasparency International*, at http://archive.transparency.org/news_room/in_focus/2011/tackling_corruption_in_greece [accessed 20 February 2013].

Craglia, M., Annoni, A., Smith, R. and P. Smits (2002). Spatial Data Infrastructures: Country Reports, *GINIE: Geographic Information Network in Europe*, at http://www.ec-gis.org/ginie/doc/SDI_final_en.pdf [accessed 05 February 2013].

de Man, W.H.E. (2004). "And if Geospatial Data Infrastructures Were Fragmented and Splintering?", *Proceeding of GISDECO 2004, GIS Seventh International Seminar on GIS in Developing Countries, May 10-12, 2004, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.*

Dessers, E., Van Hootegem, G., Crompvoets, J. and P.H.J. Hendriks (2010). "Developing Spatially-Enabled Business Processes: The Role of Organisational Structures", in Rajabifard A., Crompvoets J., Mohsen K. and K. Bas (Eds.), *Spatially Enabling Society, Research, Emerging Trends, and Critical Assessment. Belgium: Leuven University Press, pp. 41-54.*

Geoinfo-Soc (2002). *Activities of Geoinfo-Soc Scientific Committee*, at http://www.ntua.gr/ontogeo/nagii/activities.pdf [accessed 20 February 2013] (in Greek).

Geoinfo-Soc (2006a). *Proposed Horizontal GI Applications*, at http://web.archive.org/web/20060115220714/http://www.nagii.gr/proposed.htm [accessed 13 February 2013] (in Greek).

Geoinfo-Soc (2006b). *Reasons and Goals for Creating an NSDI in Greece*, at http://web.archive.org/web/20060103212918/http://www.nagii.gr/aim.htm [accessed 12 February 2013] (in Greek).

Georgiadou, Y., Bernard, L. and S. Sahay (2006). Implementation of Spatial Data Infrastructures in Transitional Economies, *Information Technology for Development, 12*(4): 247-253.

Georgiadou, Y., Puri, S. K., and S. Sahay (2005). Towards a Potential Research Agenda to Guide the Implementation of Spatial Data Infrastructures - A Case Study from India, *International Journal of Geographical Information Science, 19*(10): 1113-1130.

GSDI Association. (2009). "Outreach and Capacity Building", in Dasgupta A.R. (Ed.), *SDI Cookbook*, at http://www.gsdidocs.org/GSDIWiki/index.php/Chapter_9 [accessed 12 February 2013].

Hanseth, O. and E. Monteiro (1998). *Understanding Information Infrastructure*, at http://heim.ifi.uio.no/oleha/Publications/bok.pdf [accessed 20 May 2013].

Harms, R. and M. Yamartino (2010). The Economics of the Cloud, *Microsoft Corporation*, at http://www.microsoft.com/en-us/news/presskits/cloud/docs/the-economics-of-the-cloud.pdf [accessed 08 February 2013].

HEMCO (2000). *HEMCO's Proposal for a Business Plan and Action Plans in OPIS*, at http://www.ntua.gr/ontogeo/nagii/protasi_okxe.pdf [accessed 21 February 2013] (in Greek).

HEMCO (2011). *Public Consultation on the Project "National Interoperability Framework of Geoinformation and Services and National Policy of Geoinformation"*, at http://www.okxe.gr/el/nea-anakoinoseis/anakoinoseis/ana-2011/57-12-ana-2011 [accessed 20 February 2013] (in Greek).

Karnavou, E. and G. Gritzas (2001). "*Assessing Achievements and Prospects of GI and GIS in Greece: Towards a Generic Conceptual Framework",* Proceedings of the *the 4th AGILE Conference on GIScience, April 19-21, 2001, Brno, Czech Republic.*

Karnavou, E. and G. Gritzas (2005). "GIS Diffusion, NSDI and the Public Debate in Greece"*, Proceedings 8th AGILE Conference on GIScience, May 26-28, 2005, Estoril, Portugal.*

Kavouras, M. (2004). *System and Data Organization of NSDI Research Program for the Information Society,* at http://web.archive.org/web/20070621110831/http://ontogeo.ntua.gr/nagii/FINAL%20Deliverable%202.2.htm [accessed 22 February 2013] (in Greek).

Kavouras, M., Arvanitis, A., Chalaris, G., Patias, P., Photis, G., Prastacos, P., Sellis, T., Soulakelis, N. and M. Kokla (2003). "NAGI2. On the

Development of a National Geographic Information Infrastructure", *Proceedings of Spatial Information Management for Sustainable Real Estate Market - Best Practice Guidelines on Nation-Wide Land Administration, May 28-31, 2003, Athens, Greece*.

Kavouras, M., Arvanitis, A., Chalaris, G., Patias, P., Photis, G., Prastacos, P., Sellis, T., Soulakelis, N. and M. Kokla (2004). "NSDI-NAGI2 Development of the NSDI", *Proceedings of the 3rd National HellasGIs Conference, March 11-12, 2004, Athens, Greece* (in Greek).

Kavouras, M. and I. Bantekas (1999). "Development of national spatial data infrastructure", *Proceedings of the 1st National HellasGIs Conference, 9-10, December, 2004, Athens, Greece* (in Greek).

Lance, K., Georgiadou, Y. and A. Bregt (2009). Cross-Agency Coordination in the Shadow of Hierarchy: 'Joining Up' Government Geospatial Information Systems, *International Journal of Geographical Information Science, 23*(2): 249-269.

Marakakis, J., Pagourtzi, E., Panopoulos, G., Tsigani, S. and T. Hatzichristos (2008). *Monitoring Report INSPIRE Directive. Proposal of Implementation & Management of EU Directive in Greece*, at http://library.tee.gr/digital/m2318/m2318_keimeno.pdf [accessed 12 February 2013] (in Greek).

Masser, I. (2005). "Some Priorities for SDI Related Research", *Proceeding of the FIG Working Week 2005 and GSDI-8: From Pharaohs to Geoinformatics, April 16-21, 2005 Cairo, Egypt.*

Masser, I., Rajabifard, A. and I. Williamson (2008). Spatially Enabling Governments through SDI Implementation, *International Journal of Geographical Information Science, 22*(1-2): 5-20.

Ministry of Administrative Reform and E-government (2012). *Transcript of Press Conference for the Greek eGovernment National Strategy*, at http://www.amna.gr/pressReleaseView.php?id=18244&doc_id=11060257 [accessed 15 February 2013] (in Greek).

Ministry of Economy and Finance (2013). *Summary of the CSF 2000-2006 in Greece*, at http://www.3kps.gr/en_2000-2006.htm [accessed 10 February 2013].

Mitsopoulos, M. and T. Pelagidis (2009). Vikings in Greece: Kleptocratic Interest Groups in a Closed, Rent-Seeking Economy, *Cato Journal, 29*(3): 399-416.

Nedovic-Budic, Z. and N. Budhathoki (2006). Technological and Institutional Interdependences and SDI–The Bermuda Square, *International Journal of Spatial Data Infrastructures Research*, 1: 36-50.

Nedovic-Budic, Z. and J.K. Pinto (2001). Organizational (Soft) GIS Interoperability: Lessons from the U.S., *International Journal of Applied Earth Observation and Geoinformation, 3*(3): 290-298.

OECD (2011). *Greece: Review of the Central Administration*. OECD Publishing, at http://dx.doi.org/10.1787/9789264102880-en [accessed 20 May 2013].

Pediaditi, K., Athanasiou, S. and K. Nedas (2010). *Member State Report: Greece 2009*, at http://www.inspire.okxe.gr/assets/docs/attachments/MR_2009_EL_v1.0.pdf [accessed 10 February 2013].

Prasopoulou, E. (2011). In Quest for Accountability in Greek Public Administration: The Case of the Taxation Information System (TAXIS), *GreeSE papers, 53,* at http://eprints.lse.ac.uk/41757/1/GreeSE%20No53.pdf [accessed 24 May 2013].

Rajabifard, A. (2002). *Diffusion of Regional Spatial Data Infrastructures: With Particular Reference to Asia and the Pacific,* PhD thesis, Melbourne, Australia: University of Melbourne.

Rajabifard, A., Binns, A., Masser, I. and I. Williamson (2006). The Role of Sub-national Government and the Private Sector in Future Spatial Data Infrastructures, *International Journal of Geographical Information Science, 20*(7): 727-741.

Rajabifard, A. and I.P. Williamson (2000). "Spatial Data Infrastructures: An Initiative to Facilitate Spatial Data Sharing", in Tateishi, R. and D. Hastings (Eds.), *Global Environmental Databases-Present Situation and Future Directions.* Hong Kong: International Society for Photogrammetry and Remote Sensing, pp. 108-136.

Rajabifard, A. and I. P. Williamson (2003). Asia-Pacific Region and SDI Activities, *Journal of GIS Development, 7*(7): 1-10.

Rajabifard, A. and I.P. Williamson (2004). "SDI Development and Capacity Building", *Proceedings of GSDI-7, January 30-February 6, 2004, Bangalore, India.*

Ramasubramanian, L. (1999). GIS Implementation in Developing Countries: Learning from Organisational Theory and Reflective Practice, *Transactions in GIS, 3*(4): 359-380.

Sher, S.W. (2005). *UN Global e-government Readiness Report 2005: from e-government to e-inclusion.* New York: United Nations Publication.

SIS (2003). *Third Meeting of the Monitoring Commitee for the Business Program "Information Society",* at http://www.infosoc.gr/NR/rdonlyres/8A425649-

16A8-4A06-87A5-AEED4D8707E6/0/%CE%A0%CE%A1%CE%91%CE%9A%CE%A4%CE%99%CE%9A%CE%913%CE%B7%CF%82%CF%83%CF%85%CE%BD%CE%B5%CE%B4%CF%81%CE%AF%CE%B1%CF%83%CE%B7%CF%82%CE%95%CF%80%CE%A0%CE%B1_081203.pdf [accessed 20 February 2013] (in Greek).

SIS (2005). *Information Society Operational Programme (OPIS)-Measure 2.4: Regional Geographic Information Systems and Innovative Actions*, at http://web.archive.org/web/20070712143530/http://www.infosoc.gr/infosoc/en-UK/epktp/priority_actions/customerservice/hiddenchannel01/metro4.htm [accessed 10 February 2013].

SIS (2010). *Detailed Implementation Data of Information Society Operational Programme (OPIS)*, at http://www.infosoc.gr/NR/rdonlyres/B6AF841E-7E4B-40A9-B7C5-8281D0984282/8404/Pinakas_Omadopoihmenwn_Ergwn1.xls [accessed 20 February 2013] (in Greek).

SIS (2013). *Operational Program 'IS'*, at http://www.infosoc.gr/infosoc/en-UK/epktp/ [accessed 21 February 2013].

Sotiropoulos, D. A. (2004). Democratization, Administrative Reform and the State in Greece, Italy, Portugal and Spain: Is There a 'Model' of South European Bureaucracy?, *Discussion Paper No. 17*, at http://eprints.lse.ac.uk/5682/1/Sotiropoulos17.pdf [accessed 27 May 2013].

Star, S.L. and K. Ruhleder (1996). Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces, *Information Systems Research, 7*(1): 111-134.

Tsigani, S. (2007). "Measures in Geoinformatics Financed by the Information Society Operational Programme (OPIS)", *Proceedings of Geoinformatics and Education - The Greek Reality, May 21-22, 2007,Athens, Greece* (in Greek).

Tziachris, P. (2010). "Approaching Spatial Data Infrastructures. Trends and Proposals", *Proceedings of the 6th National HellasGIs Conference, December 2-3, 2010, Athens, Greece* (in Greek).

van Loenen, B. and van Rij, E. (2008). "Assessment of Spatial Data Infrastructures from an Organisational Perspective", in Crompvoets J., Rajabifard A., van Loenen B. and T. Delgado Fernández (Eds.), *A Multi-View Framework to Assess SDIs.* Melbourne, Australia: Wageningen University, pp. 173-192.

van Orshoven, J. and P. Beusen (2006). *Spatial Data Infrastructures in Greece: State of Play Autumn 2006*, at http://inspire.jrc.ec.europa.eu/reports/stateofplay2006/rcr06GRv71.pdf [accessed 10 February 2013].

Vandenbroucke, D. (2007). *Spatial Data Infrastructures in Europe: State of Play 2007*, at http://inspire.jrc.ec.europa.eu/reports/stateofplay2007/INSPIRE-SoP-2007v4.pdf [accessed 22 February 2013].